THERMAL ENVIRONMENTAL

HYSIDE PROJECTS SUBTWO PTY LTD

21 Parramatta Road Homebush

REFLECTIVITY ASSESSMENT REPORT

Report: S-R2019111900
20th December2019

REVISION STATUS

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Disclaimers:

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EXECUTIVE SUMMARY

The proposed stage 2 development located at the corner of 5 Powell Street and 17-35 Parramatta Road, Homebush comprises the construction of a mixed use multi-unit residential building. The development consists of:

- 4 Levels of Basement;
- Ground floor retail and lobby
- Level 1 – 7 – serviced apartments;
- Level 8 – communal terrace, residential apartments; and
- Level 9 to 24 – Residential apartments.
- Roof level.

The typical floor façade element consists of:

- Glazed element integrated with balustrades;
- Faceted concrete panels;
- Prefinished Aluminium window frame and metal trims; and
- External shading devices.

The reflectivity assessment report assesses the impact of solar reflections of the proposed development on surrounding drives, in terms of reduced visibility of visual tasks. This assessment is carried out using glare calculation method using luminance calculation. The computation of disability glare is then expressed as percentage using the ratio of veiling luminance and adaptation luminance or background luminance called threshold increments.

The assessment has identified potential gare issues with some of the façade orientation and the observer locations. We recommend all glazing to have a visible light reflectance of less than 20% to reduce the likeliness of adverse solar glare along with other mitigating factors such as façade elements, shading devices and avoiding using polished or reflective surfaces.

1. INTRODUCTION

The proposed stage 2 development located at the corner of 5 Powell Street and 17-35 Parramatta Road, Homebush comprises the construction of a mixed use multi-unit residential building. The development consists of:

- 4 Levels of Basement;
- Ground floor retail and lobby
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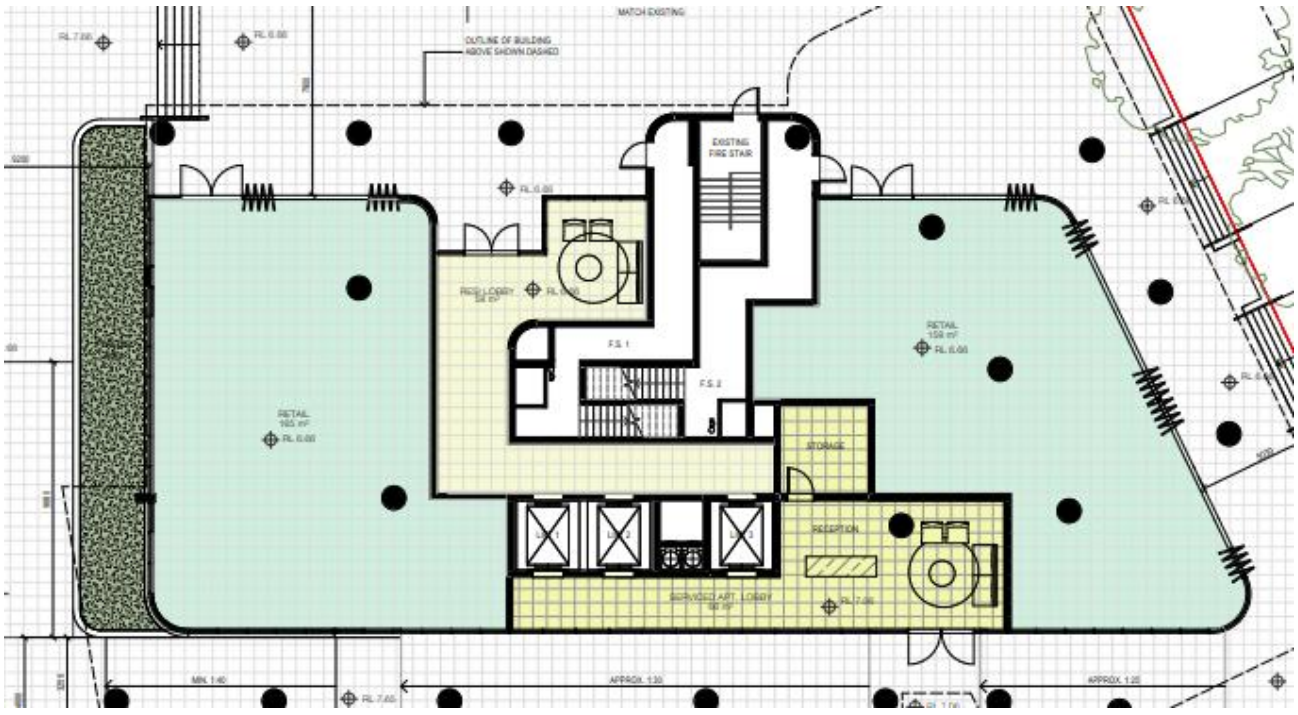
- Level 9 to 24 – Residential apartments.
- Roof level.

The typical floor façade element consists of:

- Glazed element integrated with balustrades;
- Faceted concrete panels;
- Prefinished Aluminium window frame and metal trims; and
- External shading devices.

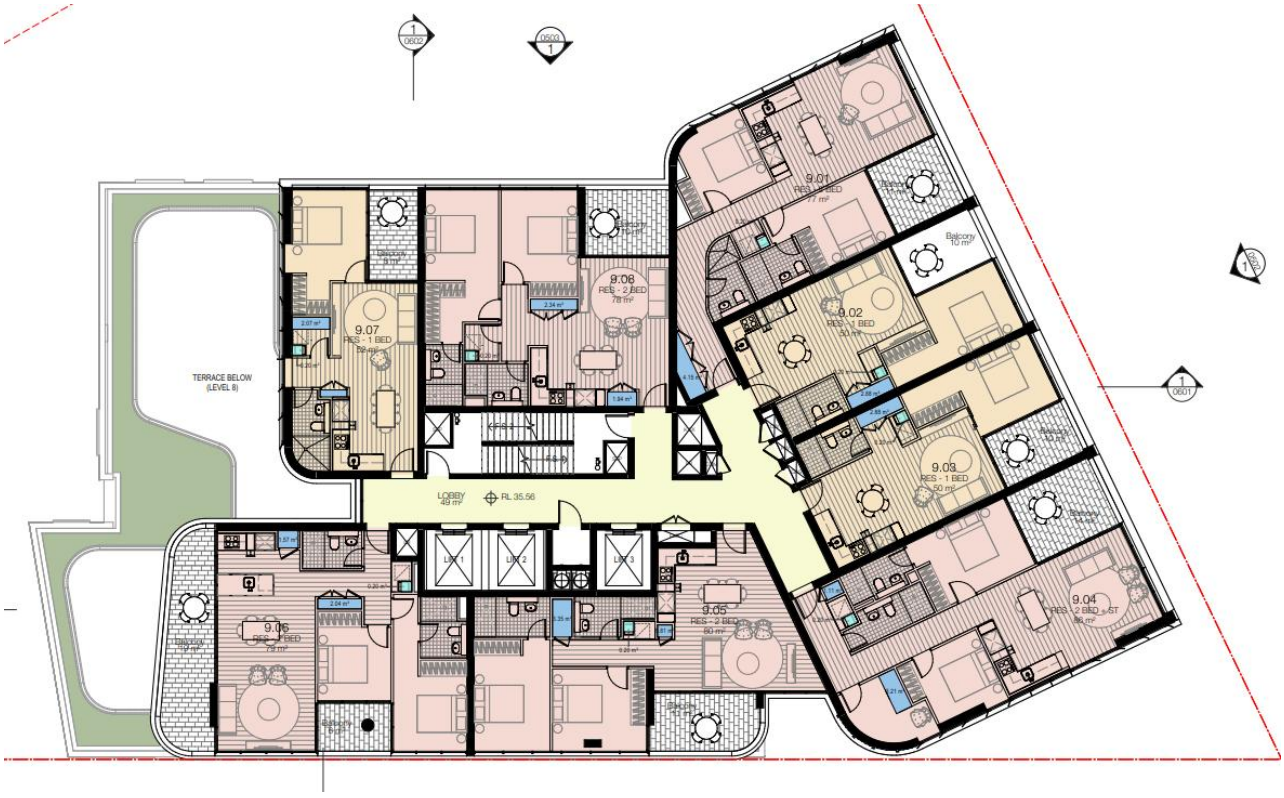
This reflectivity report assesses the impact of solar reflections of the proposed development on surrounding drives such as pedestrian, motorist, waterways and railways.

Drivers, pedestrians and neighbouring building occupants will observe the building's facades. Figure 1 shows the typical floor plans low rise and high rise with aspects of each façade. Figure 2 shows elevations of the building.



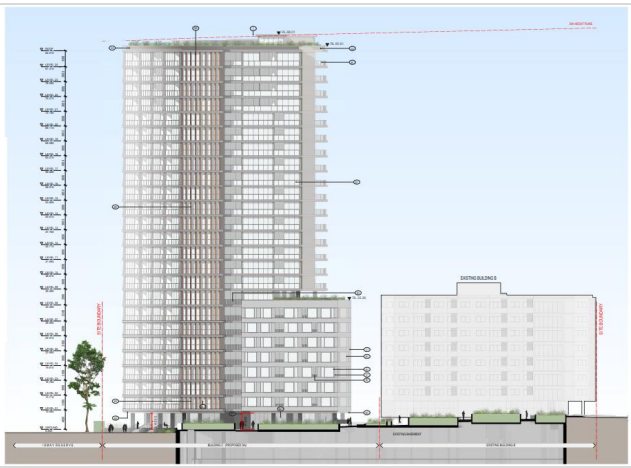
Ground – Retail

Levels 5 – 7 – Serviced Apartments – Typical Levels.

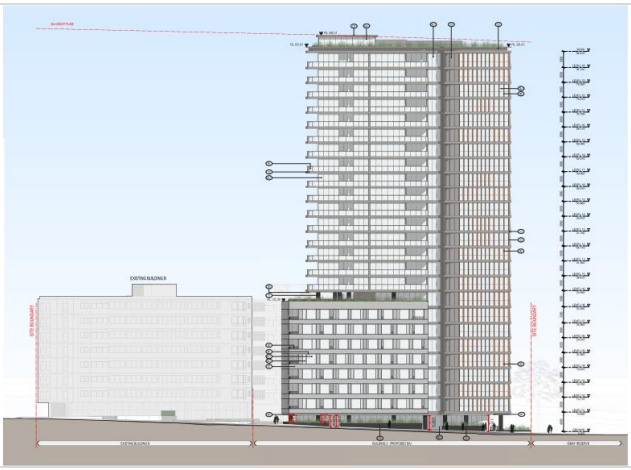


Level 9-24 – Residential typical

Figure 1: Some Typical Levels

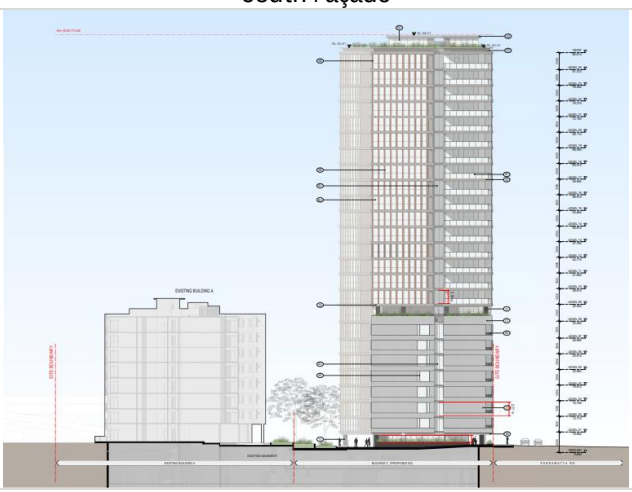


North Façade



South Façade

East Façade



West Façade

Figure 2: Building Facades

Summary of building fabric is below as per the DA documentation.

MATERIALS LEGEND

GLAZING
GL1 LOW REFLECTIVITY CLEAR GLAZING
FRAME: P1 FINISH
GL2 LOW REFLECTIVITY OPAQUE GLAZING
FRAME: P1 FINISH

BALUSTRADE
B1 LOW REFLECTIVITY CLEAR GLAZING
FRAME: P1 FINISH
B2 LOW REFLECTIVITY OPAQUE GLAZING
FRAME: P1 FINISH
B3 METAL PALISADE - P2 FINISH

METALWORK
M1 EXPRESSED ALUMINUM WINDOW FRAME - P1 FINISH
M2 ALUMINIUM SHADING FINS - P3 AND P4 FINISH
M3 METAL CLAD SOFFIT
P1 GREY POWDERCOAT FINISH
P2 DARK GREY POWDERCOAT FINISH
P3 ALUMINIUM SHADING FINS - FINISH 1
P4 ALUMINIUM SHADING FINS - FINISH 2

CONCRETE
C1 CONCRETE - LIGHT GREY TEXTURED FINISH
C2 CONCRETE - LIGHT GREY FINISH

TILING
T1 BLACK TILES

1.1 ASSESSMENT METHODOLOGY

Any glazed building has the potential to cause solar reflections in many directions at any time at which the sun is visible. This study assesses the importance of these reflections in terms of disability glare. Disability glare is defined as reflections which impacts the observer in a way that they are unable to perform a visual task, such as driving or reading without taking indirect action such as turning away or raising a hand to shield the eyes. It is critical that a driver's view is unaffected by disability glare as this has the potential to case road accidents.

Calculations provide veiling reflected luminance in the eyes of the observers. Luminance is measured in cd/m^2 (candela per meter squared) and is a representation of how bright a surface will appear to the human eye. Where this figure exceeds the level 500 cd/m^2, the solar reflection is considered excessive.

The methodology employed in this report includes the calculation of veiling reflected luminance and then calculate the ratio of veiling luminance to adaptation luminance expressed as a percentage. The adaptation luminance is the sum of the veiling luminance from the scene and the background luminance. This ratio is of veiling luminance to adaptation luminance is called the threshold increments.

AS 4282-1997 defines Threshold Increments (TI) as the measure of disability glare expressed as the percentage increase in contrast required between an object and its background for it to be seen equally well with a source of glare present. Note higher values of TI corresponds to greater disability glare. The definition in CIE 150:2003 is similar. In this assessment any TI exceedence of 10 is considered to be a glare issue.

The TI is represented as follows:

$TI = 65\ L_v/(L_{ad})^{0.8}$

Where L_v is the veiling luminance and L_{ad} is the adaptation luminance or background luminance.

Following steps are followed for the disability glare assessment using this method.

- The size, orientation and extent of reflective surface on each façade are determined by examining drawings provided by the architect, the site and surrounds and expected glazing elements.
- Several observers are chosen for critical facades representing drivers and pedestrians
- Time at which the sun is reflected off the façade and determine as well as the directions in which it is reflected.
- For each observer, several times are selected at which solar reflections are assessed for their affect on the observer.
- For each observer and each selected time the equivalent veiling luminance in the eye of the observer is calculated using a benchmark glass of visible light reflectance of 20%. This involves calculations of the strength of solar illumination, the position of the sun in front of the façade, the apparent position of the sun reflected in the façade, and apparent position of the sun reflected in the façade and the reflected solar illumination received by the observer.
- The calculated equivalent veiling luminance is compared with the maximum allowed level of 500 cd/m^2.
- For situations where the maximum level is exceeded, the case is further investigated to assess whether the offending section of façade is shaded by external shading devices or adjoining buildings, within the observer's view of the façade, and present a large solid angle to the observer.
- If the offending façade section is shaded beyond the view of the observer's or too small to reflect the sun to the observer, the case is disregarded. Where there is no shade projected towards the driver's sensitive vision is reduced below 500 cd/m^2. The new reflectance is then considered the maximum reflectance allowed for that particular section of the façade.

- With knowledge of the impact of solar reflections on numerous observers for each façade, the investigation is generalised for all similar observers within sight of each façade.
- For calculation purposes, it is assumed that drivers and pedestrians face horizontally and parallel to the direction of travel

1.2 DOCUMENTATION

The following documentation, issued on 18th December 2019, by SJB Architects is used in the preparation of this report.

Sheet No	Sheet Name	Rev
0001	Cover	2
0101	Site Location	3
0102	Site Plan and Analysis	4
0103	Survey Plan	2
0201	Basement 4	4
0202	Basement 3	4
0203	Basement 2	4
0204	Basement 1	4
0205	Ground	6
0206	Level 1 - Level 4	6
0207	Level 5 - Level 7	2
0208	Level 8	7
0209	Level 9 - Level 19	6
0210	Level 20 - Level 23	6
0211	Level 24 / Roof	4
0501	Elevation - South (Parramatta Road)	5
0502	Elevation - East (Arnotts Reserve)	5
0503	Elevation - North	5
0504	Elevation - West	5
0601	Section A	5
0602	Section B	5
1401	Apartment Types - Adaptable and Accessible Apartments	3
2901	Area Calculations - GFA	2
3101	Shadow Diagrams	3
3201	Analysis - Solar and Cross Flow	3
3301	3D Views	2
3401	External Material and Finishes	1
4001	Visualisation - View from Parramatta Road	2
4002	Visualisation - View from Arnotts Reserve	2

2. FAÇADE ORIENTATION AND OBSERVER LOCATIONS

Figure 4 below shows the façade orientation for ground floor and typical levels (level 5 to 7 and level 9 to 24).

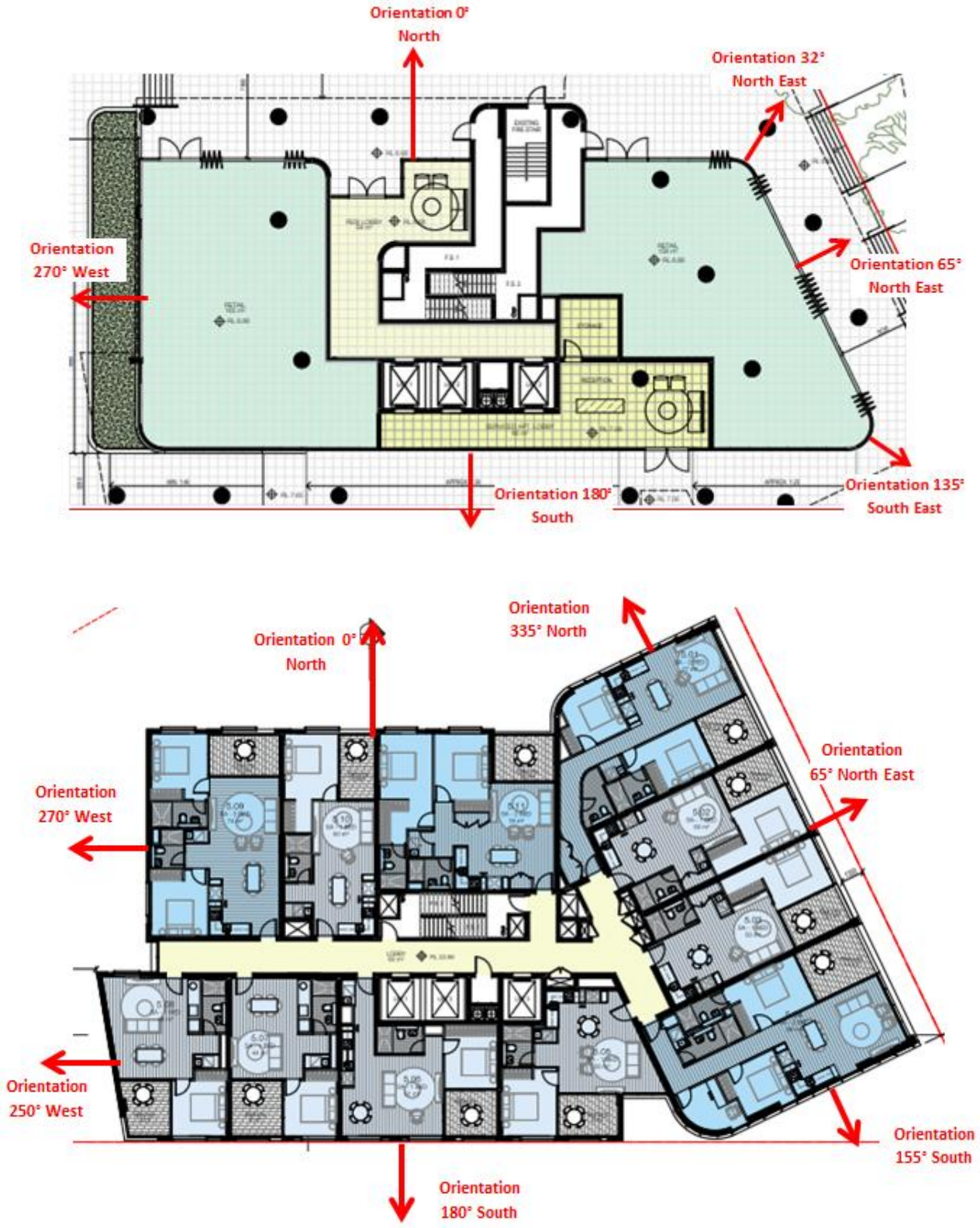


Figure 3: Façade Orientation

Figure 5 below shows the observer viewing points. Location of each viewing point is also summarised.

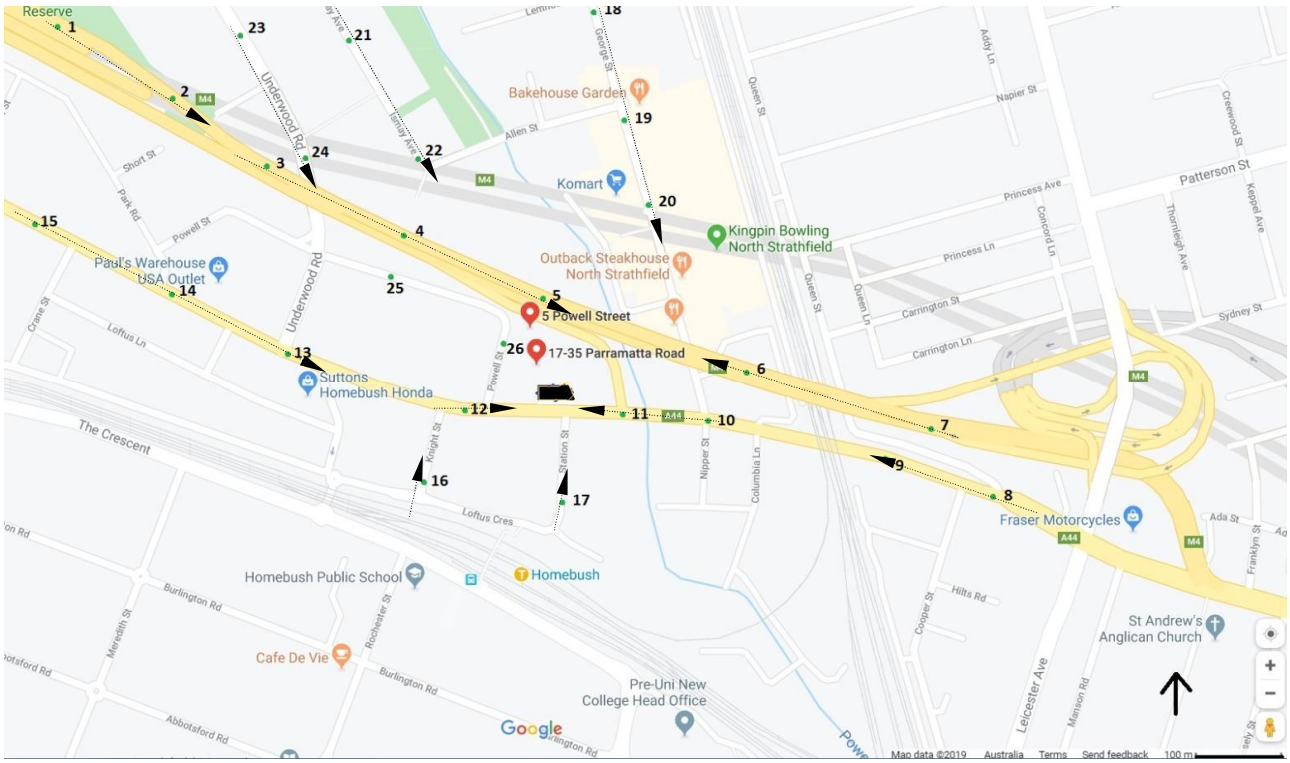


Figure 4: Observer Viewing Points Observer Location with Line of Sight

Position of Selected Points is described below:

- Points 1, 2, 3, 4, 5, 6 and 7 are located along the M4 – Western motorway;
- Points 8, 9, 10, 11, 12, 13, 14 and 15 are located along the Parramatta Road;
- Point 16 on Knight Street;
- Point 17 on Station Street;
- Points 18, 19, 20 are along the George Street;
- Points 21 and 22 along the Ismay Avenue;
- Points 23 and 24 along the Underwood Road; and
- Points 25 and 26 are along the Powell Street.

Table 1 summarise the façade orientation and the points from where each façade orientation can be viewed from and any glare due to reflection is identified for each observer point as shown in Figure 5.

Table 1: Summary of Façade Orientation and Observer Location and Angle of View

Building Levels	Façade Orientation	Observer Points	Observer Position (Angle°)
Ground Floor (Retail)	Orientation 0° (North)	1 and 2	130°
		3, 4 and 5	115°
		6 and 7	285°
		18, 19 and 20	165°
		21, 22, 23 and 24	165°
		13 and 14	115°
	Orientation 32° (North East)	1 and 2	130°
		3, 4 and 5	115°
		6 and 7	285°
		8 and 9	290°
		10 and 11	270° and 90°
		18, 19 and 20	165°
		21, 22, 23 and 24	165°
	Orientation 65° (North East)	6 and 7	285°
		8 and 9	290°
		10 and 11	270° and 90°
		17	5° and 185°
		20	105°
	Orientation 135° (South East)	6 and 7	285°
		8 and 9	290°
		10 and 11	270° and 90°
		17	5° and 185°
		20	165°
	Orientation 180° (South)	10	270°
		11 and 12	270° and 90°
		16	10°
		17	5°
	Orientation 270° (West)	1 and 2	130°
		3 and 4	115°
		12	90°
		13, 14 and 15	115°
		21, 22, 23 and 24	150°
		25	110°
Level 1to 7 (Serviced Apartments)	Orientation 0° (North)	1 and 2	130°
		3, 4 and 5	115°
		6 and 7	285°
		18, 19 and 20	105°
		21, 22, 23 and 24	165°
		13 and 14	115°

	Orientation 65° (North East)	6 and 7	285°
		8 and 9	290°
		10 and 11	270° and 90°
		17	5° and 185°
		20	105°
	Orientation 135° (South East)	6 and 7	285°
		8 and 9	290°
		10 and 11	270° and 90°
		17	5° and 185°
		20	165°
	Orientation 180° (South)	10	270°
		11 and 12	270° and 90°
		16	10°
		17	5°
	Orientation 270° (West)	1 and 2	130°
		3 and 4	115°
		12	90°
		13 and 14	115°
		21, 22, 23 and 24	330°
Level 8 – 24/Roof (Residential Apartments)	Orientation 0° (North)	1 and 2	130°
		3, 4 and 5	115°
		6 and 7	285°
		18, 19 and 20	105°
		21, 22, 23 and 24	165°
		13 and 14	115°
	Orientation 65° (North East)	6 and 7	285°
		8 and 9	290°
		10 and 11	270° and 90°
		17	5° and 185°
		20	105°
	Orientation 135° (South East)	6 and 7	285°
		8 and 9	290°
		10 and 11	270° and 90°
		17	5° and 185°
		20	165°
	Orientation 180° (South)	10	270°
		11 and 12	270° and 90°
		16	10°
		17	5°
	Orientation 275° (West)	1 and 2	130°
		3 and 4	115°
		12	90°

		13 and 14	115°
	Orientation 270° (West)	1 and 2	130°
		3 and 4	115°
		12	90°
		13 and 14	115°

2.1. OBSERVER POINTS AND ADVERSE GLARE

This section of the report provides further analysis for each point where potential glare issue is observed and potential glare is summarised in Table 2. There may be other potential glare issues, all observer points cannot be analysed, however some discrete observer points on the streets indicates potential source of adverse glare. The adverse glare is identified as follows:

- Along the Parramatta road is from south East, South, and west façade. North façade;
- Along M4 is from North East facade

Table 2: Façade Orientation, Observer Location and Adverse Glare

Façade Orientation	Observer Points	Adverse Glare
Orientation (South East and South)	11	Glare Identified - Observer Point 11 – on Parramatta Road
Orientation (North East)	6	Glare identified – Observer point 6 M4 – Western Motorway
Orientation (West)	12	Glare Identified - Observer Point 12 on Parramatta Road

2.2. NEIGHBOURING BUILDINGS AND OCCUPANTS

More research will be required to properly assess the impact of reflectivity or veiling luminance to occupants of neighbouring buildings. The impact of glare is dependent on a number of factors and some these are listed below:

- Glare intensity;
- Duration of glare impact;
- Type of glazed element used on facades such as clear, tinted;
- Shading devices; and
- Level of tolerance, acceptance and age factor.

To limit the glare impact we recommend the glazing reflectivity be limited to not greater than 20% to avoid adverse solar glare to occupants of neighbouring buildings.

CONCLUSION

The analysis presented within this report has identified potential glare conditions from the proposed development. For most of the façade the neighbouring structures and buildings will block the adverse glare. Out of all the observer point location of the most significant ones are Observer points 11 and 12.

To limit the potential glare issues we recommend following mitigating factors:

- Use façade materials that have more diffuse and less specular reflection;
- The development incorporates shading devices to minimise the extent of glare, we recommend the shading devices to have non-glossy finish;
- Use glass which will have a visible light reflectivity of less than 20%; and
- Use non reflective façade materials such as louvered metal screens which have nonglossy finish rather than buffed or polished.

Of the most important mitigating factor the glazing to satisfy visible light reflectivity of less than 20%. The additional mitigating factors will help reduce the adverse glare effects on motorist and pedestrians.

With the above recommendations satisfied the result of this analysis will indicate that the proposed development will limit the adverse glare for significant duration of time in any given day. However there could be other locations on the streets and roads which are not assessed and covered by this report which may cause adverse glare.